THE FIRST WINGLESS STONEFLY FROM AUSTRALIA*

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INTRODUCTION

The first wingless stoneflies (two species of *Apteryoperla*) were described by Wisely (1953) from high-mountain grasslands in New Zealand. They were obtained, together with their larvae(!), far from any water in the damp atmosphere of alpine tussocks and under stones. The same terrestrial way of life is obvious for the larvae of some other wingless *Apteryoperla* species which Illies (1963a) described from the subantarctic Campbell and Auckland Islands (both within the realms of New Zealand). Here, however, the same genus yields a truly aquatic species too, *Apteryoperla longicauda,* indicating that terrestrial or semi-terrestrial larval life is not essential for this type of apterous gripopterygid. As the male genitalia do not show any marked difference between the genera *Apteryoperla* and *Aucklandobius,* it seems that even the lack of wings in *Apteryoperla* is not really a generic character but has to be considered as a virtual adaptation at the species level of a genus which embraces both groups (and which, consequently, should be named *Aucklandobius*).

In the Patagonian Andes of Chile and Argentina, some years ago, the same life-type of wingless and semi-terrestrial Plecoptera was found (Illies 1960, 1963): the new genera *Megandiperla* and *Andiperlodes,* which belong to different subfamilies of Gripopterygidae. Describing a wingless stonefly *Andiperla* from Patagonian Argentina, Aubert (1956) had previously erected the subfamily Andiperlinae, which was to harbour all apterous genera of Gripopterygidae. In a special study of this problem (Illies 1964) it was shown that this subfamily is unnatural as it is based on only secondary convergences (lack of ocelli and wings, semi-aquatic larval life) and not on synapomorphies. It was rejected, therefore, and in the modern system of Plecoptera the wingless genera now are incorporated into several subfamilies of the family Gripopterygidae.

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DESCRIPTION

Leptoperla darlingtoni nov. spec.

Measurements: (in mm.)	Body length	Antenna	Cercus
♂	6	8	2.5
♀	12	8	3

General color: Brown with dark markings on pronotum and lighter patches on meso- and metanota. *Head:* Frons uniform brown. Ocelli visible. Eyes bulged forward. Epicranium mottled in brown and darker brown. Antennae with very fine covering hairs. *Pronotum:* Almost square with angles slightly rounded. *Meso- and metanota:* Wing vestiges present as small flaps which are without venation and slightly project posteriorly past hind margins of their respective nota. *Legs:* Brown with slightly lighter color on middle of femora and tibiae. *Abdomen:* Uniform brown. Tergites of male chitinised overall; those of female fully chitinised in tergites I, VIII, IX and X but II-VII chitinised only medially. *Male genitalia:* Tergite X trapezoid with tergite XI projecting from its posterior margin in form of a narrow cone. Epiproct tapered to small down-turned tip; ventral keel present and dorsal margins each with 3 or 4 teeth. Paraprocts taper to down-curved apices. Subgenital plate with medial notch on posterior margin. *Female genitalia:* Subanal lobes almost triangular with wide bases. Subgenital plate produced to form two lobes either side of a medial notch. Tergite X with triangular hind margin, its apical angle obtuse.

MATERIAL: Holotype ♂ and allotype ♀, Paratypes 7 ♂♂ and 3 ♀♀ Mt. Donna Buang, Victoria, 6-7 /xii/1931, P. J. Darlington. (1 ♂ 1 ♀ paratype pinned, the remaining specimens relaxed and in alcohol). Coll. Mus. Comp. Zool. Harvard University.

AFFINITIES

The new species, judging from the genitalia, belongs within the group of Australian Leptoperlinae which in the present system (Illies 1966) is harboured in the genus *Leptoperla*. In a recent revision of Australian gripopterygids, studying the abundant material of my collection from Australia and Tasmania in 1966, I. McLellan has split the *Leptoperla*-Complex into several well characterized new genera. After the publication of his results, *L. darlingtoni* nov. spec. will find its definite place in one of these new genera. It appears to be closely related to *L. rugosa* Kimmins from East Australia (N.S.W.).

ECOLOGY

The mountain of Donna Buang, Vic., has one of the typical high-alpine grassland sites almost above the timber-line, where such wingless forms could be expected (judging from New Zealand and

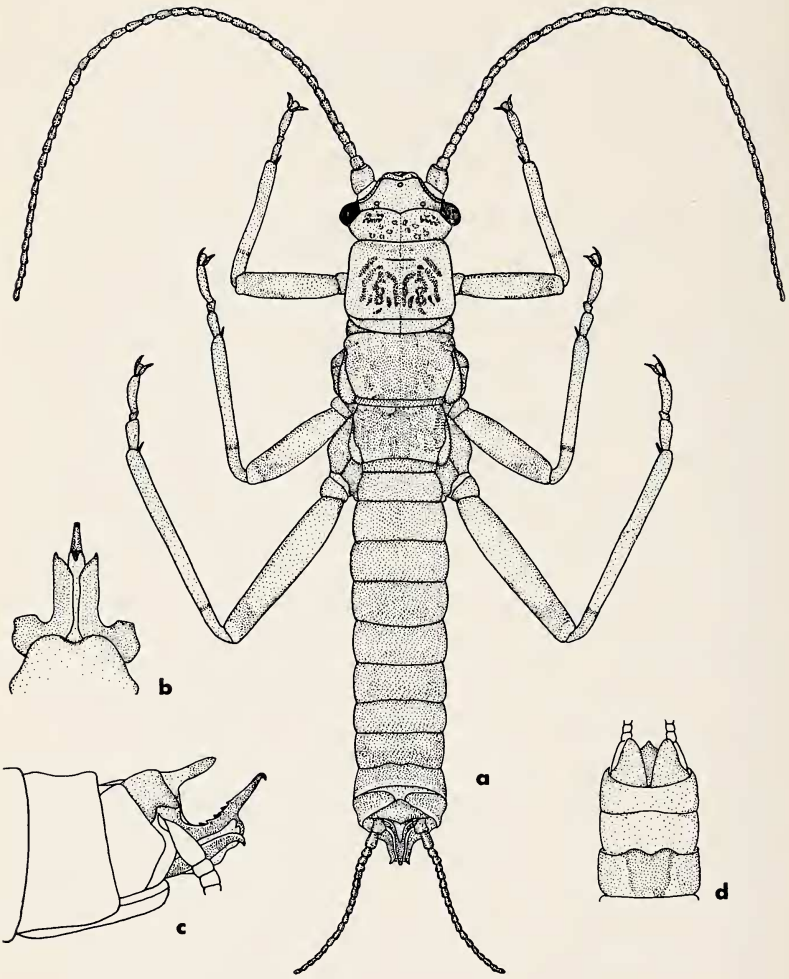

Figure 1. *Leptoperla darlingtoni* nov. spec. Male, a: whole specimen; b: abdominal tip and genitalia, ventral; c: same, lateral; d: female, abdominal tip, ventral.

Patagonian experiences with the respective representatives of this life-type). As my own efforts in Mt. Kosciusko and on several Victorian peaks did not result in finding wingless stoneflies and as the activities of very able and effective collectors like E. Riek and A. Neboiss in suitable places during recent years did not succeed in such findings, the Mt. Donna Buang locality must be considered especially propitious for the evolution and persistence of such a species. The fair quantity of specimens collected by P. J. Darlington at this place did not include larvae, so the question of their aquatic or semi-terrestrial life must remain unsettled. Compared with the similar climatic circumstances in the occurrence of wingless species in the closely related genus *Apteryoperla* one should expect, however, that the larvae of *L. darlingtoni* nov. spec. are not obligatorily water-bound, and could be obtained in company of the adults at a certain distance from fluid water.

Gripopterygid larvae of many genera are specially adapted to the extreme conditions of life in very high elevation, above the timberline and in melting glacier water. They are normally the uppermost colonists in high alpine creeks of the Notogea and Neogea, and exceed by far the ability of other families of Plecoptera to withstand these conditions. The very high oxygen content of extremely cold water together with the remote metabolic rate of oxygen consumption at low temperature, causes in many members of this family a marked reduction in the importance of the abdominal gills for respiration; the gill tuft becomes sparse and may even be completely lacking as in the Andean genus *Notoperla.* The respiration activity has shifted to the abdominal body wall. Larvae of this genus, therefore, obtain a certain ability to breathe outside the water in a humid atmosphere (they normally survive for several days if kept in moist moss).

The high exposed places of their occurrence, especially melting glacier water, are very poor for the obtaining of nutriment; only little algae vegetation being available. There must consequently be an urge to search for food out of the water in the moist atmosphere on the vegetation of the banks and within the low grass and under nearby stones. Thus the ability to leave the water in the larval stage may be the reason for these high-mountain dwellers to spread into the neighboring humid terrestrial biotopes.

The phenomenon of evolution of brachypterous populations at such places is reported for Plecoptera of all families and from all continents, e.g., from Scandinavia by Brinck 1949. Parallel urge of winglessness as adaptation on wind-selection at exposed places and terrestrial life as adaptation against poor alimentary situation within

the water bodies, result in the peculiar life-type of wingless and semi-terrestrial stoneflies in the family Gripopterygidae. It occurs in suitable places, i.e., on high, wind exposed, extremely cold and humid localities in South America, Australia and New Zealand, which means: within the whole range of distribution of the family Gripopterygidae.

ZOOGEOGRAPHY

The evolution of an apterous plecopteran species obviously needs a considerable time of unaltered favorable conditions in a given place. That is the reason why only from localities with long-lasting cool and humid climate this life-type has been recorded; its existence indicates a relictary character of the respective fauna. This was pointed out for the fauna of Campbell Island (Illies 1964a), but it should be true as well, for the locality of Mt. Donna Buang, Vic., where the new species *L. darlingtoni* was obtained. The Victorian mountains are evidently the place in Australia where the most relictary types of Plecoptera are found: the eustheniid genus *Thaumatoperla* as well as some new, not yet described, genera of austroperlids and notonemourids are restricted to this area. In its refugial function this isloated Victorian high mountain range even overshadows the importance of Tasmania as a refuge of old plecopteran groups.

This is more astounding as the Mt. Kosciusko region (N.S.W.) with its even higher elevation has not yet produced any peculiar type of Plecoptera. The importance of the Victorian ranges, therefore, cannot be explained from their high elevation but must be due to the fact that this southern region of the Australian alps is by far more extended and variable in climatic conditions thus offering a large scale of possible refuges for cool-adapted and specialised stoneflies during the climatic changes of the Pleistocene. Further exploration of the Australian cool-adapted freshwater fauna, therefore, should be concentrated on the high peaks of Eastern Victoria.

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